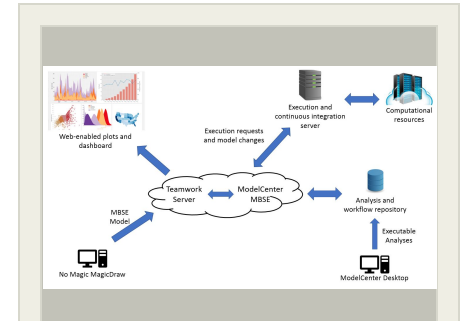## Project Introduction

Model-Based Systems Engineering (MBSE) has been increasingly embraced by
both industry and government as a means to keep track of system complexity.
It allows the engineer to represent the system in a comprehensive computer
model allowing for better traceability, tracking, and information consistency.
The vision and promise of MBSE is one where systems models and analyses
are tightly integrated in an automated, collaborative, easily accessible and
secure framework. However, the current state-of-the-art falls short of this
promise due to a significant gap between MBSE tools and its integration with
analysis tools. Phoenix Integration proposes to develop and prototype a
framework that would help realize the vision and promise of MBSE. This
prototype framework will be web-based, utilizing existing tools and
frameworks already deployed and being used at NASA. This will be done by
leveraging available existing technology as well as commercial products
currently under development. At the center of the framework is the connection
between No Magic Teamwork Server and ModelCenter® MBSE. Teamwork
Server is a web-based MBSE collaboration platform, while ModelCenter®
MBSE is a next generation MBSE analysis integration tool currently being
commercially developed at Phoenix Integration. This framework will be
connected to distributed or high performance computing resources for quick
analysis execution, as well as a continuous integration server for automated
execution in response to a model change. In addition to being able to interact
with the systems model through a web environment, the user would be able to
execute the associated analyses and workflows using information from the
systems model. Automatic requirements verification can be performed through
automated analysis execution whenever a change in the systems model is
detected. Results can be displayed on a web-enabled dashboard, together with
interactive charts and plots to help visualize results and data.

Anticipated Benefits

These capabilities will directly benefit ongoing and future NASA projects and
initiatives, such as Mars 2020 and Europa Clipper missions, the Team X and
related collaborative design teams, as well as all future science missions.
NASA would be able to leverage this technology on any project that involves a
significant level of technical and programmatic complexity. This includes most
of NASA's Space Exploration and Air Vehicle initiatives at NASA Research
Centers such as Langley and Goddard.

This technology will benefit all programs adopting Model Based Systems
Engineering (MBSE), including those at the Department of Defense as they
design the next generation air, land and sea-based systems. Commercial
organizations such as Lockheed Martin, Northrop Grumman, and Boeing will
also benefit as they implement MBSE activities in their own organizations.
Other industries such as automotive, pharmaceutical and manufacturing could
take advantage of the innovative technology developed here.

Pushing the State of the Art: A
Web-enabled MBSE Analysis
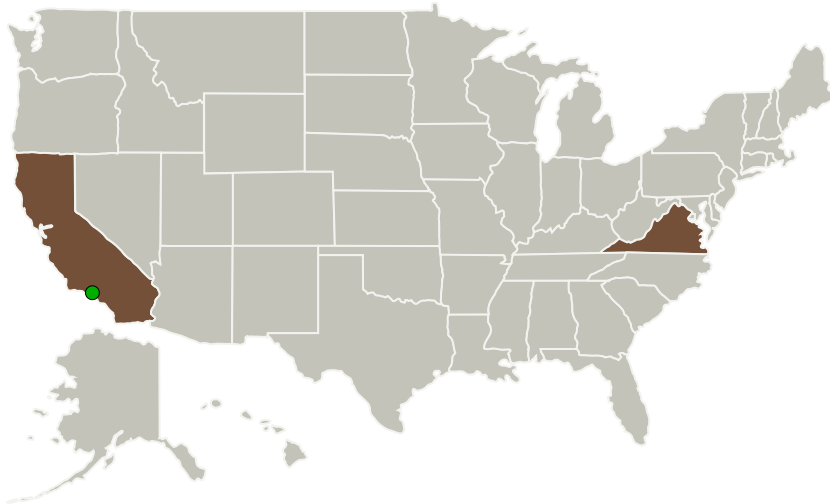Integration Framework, Phase I

Table of Contents

Primary U.S. Work Locations and Key Partners

Organizations Performing Work	Role	Type	Location
Phoenix Integration	Lead Organization	Industry	Blacksburg, Virginia
● Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
California	Virginia

Project Transitions

▶ **July 2018:** Project Start

✓ **February 2019:** Closed out

Closeout Documentation:
- Final Summary Chart(*https://techport.nasa.gov/file/137889*)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Phoenix Integration

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management
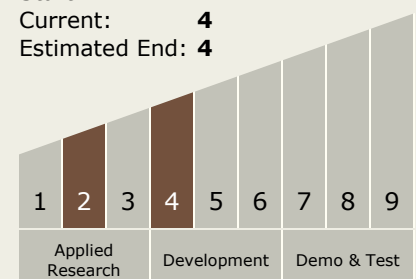
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Andy Ko

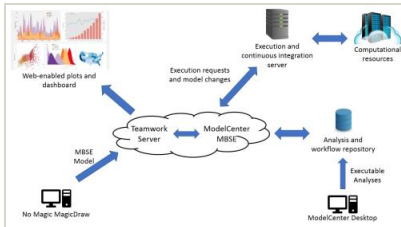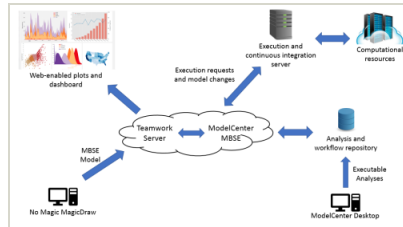## Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**

Images

Briefing Chart Image
Pushing the State of the Art: A Web-enabled MBSE Analysis Integration Framework, Phase I
(https://techport.nasa.gov/image/133635)

Final Summary Chart Image
Pushing the State of the Art: A Web-enabled MBSE Analysis Integration Framework, Phase I
(https://techport.nasa.gov/image/129496)

Technology Areas

Primary:

- TX11 Software, Modeling, Simulation, and Information Processing
  └ TX11.3 Simulation
    └ TX11.3.3 Model-Based Systems Engineering (MBSE)

Target Destinations

Earth, Mars, Others Inside the Solar System